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071/37530

APPLICATION NO. (IF KNOWN, SEE 37 CFR

09/889439

INTERNATIONAL APPLICATION NO.
PCT/EP00/10611INTERNATIONAL FILING DATE
October 27, 2000PRIORITY DATE CLAIMED
November 22, 1999TITLE OF INVENTION METHOD AND DEVICE FOR THE STERILIZATION
OF PACKAGING CONTAINERSAPPLICANT(S) FOR DO/EO/US Erwin Knieling
Hans Hiendl

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. This is an express request to begin national examination procedures (35 U.S.C. 371(c)(9) and (24) indicated below.
4. The US has been elected by the expiration of 19 months from the priority date (Article 19(1)(b)(ii) of the PCT).
5. A copy of the International Application as filed (35 U.S.C. 371(c)(2))
 - a. is attached hereto (required only if not communicated by the International Bureau).
 - b. has been communicated by the International Bureau.
 - c. is not required, as the application was filed in the United States Received Office (RO/US).
6. An English language translation of the International Application as filed (35 U.S.C. 371(c)(2))
 - a. is attached hereto (with translator's certificate).
 - b. has been previously submitted under 35 U.S.C. 154(d)(4).
7. Amendments to the claims of the International Application under PCT Article 19(1)(b)(ii) of the PCT.
 - a. are attached hereto (required only if not communicated by the International Bureau).
 - b. have been communicated by the International Bureau.
 - c. have not been made; however, the time limit for making such amendments has NOT expired.
 - d. have not been made and will not be made.
8. An English language translation of the amendments to the claims under PCT Article 19(1)(b)(ii) of the PCT.
9. An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)) (In Blank)
10. An English language translation of the annexes of the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).
11. A copy of the International Preliminary Examination Report (PCT/IPEA/409).
12. A copy of the International Search Report (PCT/ISA/210).

Items 13 to 20 below concern document(s) or information included:

13. An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
14. An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
15. A **FIRST** preliminary amendment.
16. A **SECOND** or **SUBSEQUENT** preliminary amendment
17. A substitute specification.
18. A change of power of attorney and/or address letter.
19. A computer-readable form of the sequence listing in accordance with PCT Rule 16.2 and 35 U.S.C. 1.821 - 1.825.
20. A second copy of the published international application under 35 U.S.C. 154(d)
21. A second copy of the English language translation of the international application under 35 U.S.C. 154(d)(4).
22. Certificate of Mailing by Express Mail
23. Other items or information. PCT Form 101, EPO Form 1031.1, CT Form 220, PCT Form 210, General Authorization.

U.S. APPLICATION NO (IF KNOWN, SEE 37 CFR 09/889439	INTERNATIONAL APPLICATION NO. PCT/EP00/10611	ATTORNEY'S DOCKET NUMBER 30071/37530
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24. The following fees are submitted:

BASIC NATIONAL FEE (37 CFR 1.492 (a) (1) - (5)) :

<input type="checkbox"/> Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO and International Search Report not prepared by the EPO or JPO	\$1000.00
<input checked="" type="checkbox"/> International preliminary examination fee (37 CFR 1.482) not paid to USPTO but International Search Report prepared by the EPO or JPO	\$860.00
<input type="checkbox"/> International preliminary examination fee (37 CFR 1.482) not paid to USPTO but international search fee (37 CFR 1.445(a)(2)) paid to USPTO	\$710.00
<input type="checkbox"/> International preliminary examination fee (37 CFR 1.482) paid to USPTO but all claims did not satisfy provisions of PCT Article 33(1)-(4)	\$690.00
<input type="checkbox"/> International preliminary examination fee (37 CFR 1.482) paid to USPTO and all claims satisfied provisions of PCT Article 33(1)-(4)	\$100.00

CALCULATIONS PTO USE ONLY

ENTER APPROPRIATE BASIC FEE AMOUNT =

**\$860.00
\$0.00**

Surcharge of **\$130.00** for furnishing the oath or declaration later than 20 30 months from the earliest claimed priority date (37 CFR 1.492 (e)).

\$0.00

CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE	
Total claims	21 - 20 =	xx 1	x \$18.00	\$18.00 \$0.00
Independent claims	2 - 3 =	0	x \$80.00	\$0.00
Multiple Dependent Claims (check if applicable).				\$0.00

TOTAL OF ABOVE CALCULATIONS = **\$878.00 ~~\$0.00~~**

<input type="checkbox"/> Applicant claims small entity status. (See 37 CFR 1.27). The fees indicated above are reduced by 1/2.	\$0.00
SUBTOTAL =	\$878.00 \$0.00

Processing fee of \$130.00 for furnishing the English translation later than <input type="checkbox"/> 20 <input type="checkbox"/> 30 months from the earliest claimed priority date (37 CFR 1.492 (f)).	\$0.00
TOTAL NATIONAL FEE =	\$878.00 \$0.00

Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31) (check if applicable).	<input type="checkbox"/> \$0.00
TOTAL FEES ENCLOSED =	\$878.00 \$0.00
	Amount to be: refunded \$

charged **\$**

- A check in the amount of **\$878.00** to cover the above fees is enclosed.
- Please charge my Deposit Account No. _____ in the amount of _____ to cover the above fees. A duplicate copy of this sheet is enclosed.
- The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. **13-2855** A duplicate copy of this sheet is enclosed.
- Fees are to be charged to a credit card. **WARNING:** Information on this form may become public. **Credit card information should not be included on this form.** Provide credit card information and authorization on PTO-2038.

NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.

SEND ALL CORRESPONDENCE TO:

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SIGNATURE

NAME **Richard B. Hoffman**

REGISTRATION NUMBER **26,910**

DATE **July 12, 2001**

09/889439

JC03 Rec'd PCT/PTC 12 JUL 2001

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

PRELIMINARY AMENDMENT

Hon. Commissioner of Patents
and Trademarks
Washington, D.C. 20231

In connection with the subject patent application, please enter the following amendment:

IN THE SPECIFICATION:

At page 1, after the title, please delete the word “Description” and add a new centered heading as follows:

--Field of the Invention--:

Page 1, please delete the first full paragraph and substitute with the following:

--The invention relates to a method and apparatus for the sterilization of packaging containers such as PET beverage bottles --

Page 1 after the first full paragraph, please add a new centered heading as follows:

--Background of the Invention--

Page 1, please delete the fourth full paragraph and substitute with the following:

--A known method also exists which is designed for the sterilization of PET bottles, where peracetic acid at a concentration of 0.1-1.5% is continuously sprayed into a pipe which carries pressurized air, by means of an atomization nozzle (DE 198 08 318 A1). The aerosol so formed is then heated in a heat exchanger, and then it is led through pipes and single-component nozzles into inverted PET bottles. After the exposure, the sterilization agent is removed by rinsing the PET bottles by spraying demineralized water.--

Page 2, after carryover paragraph, please insert a centered heading as follows:

--Summary of the Invention--;

Page 2, please delete second full paragraph.

Page 2, please delete the fourth paragraph and substitute with the following:

--Because of the direct application by spraying of the disinfectant-steam mixture onto the packaging containers by the mixing nozzles, no heating chamber, pipes etc. are needed, in which the mixture could condense. The mixing nozzles can thus be operated in cycles, and even longer interruptions of the operation have no negative effects. By an appropriate design of the mixing nozzles, and the resulting shape of the jets of the mist-like mixture, the latter can be blown or applied as a mist into narrow mouth openings or broadside onto the external wall of packaging containers. In addition, it is possible to set an exact dosage of the mixture which is applied as a mist onto a packaging container, and thus achieve a considerable savings in consumption.--

Page 2, after fourth full paragraph, please insert a centered heading as follows:

--Brief Description of the Drawings--.

Page 3, please delete description of Figure 3 and substitute with the following:

--Figure 3 is detail X of Figure 2 at an enlarged scale--;

Page 3, after description of Figure 5, please insert a new centered heading as follows:

--Detailed Description of the Invention--.

Page 3, please delete second full paragraph and substitute with the following:

--The injection machine 5 has a stationary housing 10, on which a rotating table 11 with a vertical rotating axle 12 is located. On the circumference of the rotating table 11, a number of elastic gripping tongs 13 according to European Patent 721 808 are rigidly attached, in an even distribution. These gripping tongs 13 hold the bottles 1 by a section below the collar of the neck in an upright position and with the opening turned upward, while the bottles move in a rotating path with the rotating table 11. The introduction and the removal of the bottles 1 into/out of the gripping tongs 13 occur by means of a one-part worm 14, and an input star 17, as described in detail in the mentioned European Patent 721,808. A pivoting of the bottles by 180° does, however, not occur. In the crosshatched treatment area, the bottles always remain in the upright normal position.--

IN THE CLAIMS:

Please delete Claims at top of page.

At line 1, before claim 1, please insert --We claim--.

Please amend the claims to read as follows:

1 (Amended). Method for the sterilization of packaging containers, comprising the steps of generating a heated disinfectant by simultaneously and separately leading a liquid disinfectant and steam to a mixing nozzle, forming a mixture of atomized or evaporated disinfectant and steam by the mixing nozzle, aiming the mixed jet of heated disinfectant which exits from the mixing nozzle directly onto a packaging container, and removing the heated disinfectant after it has acted on the surface of the packing container to be sterilized.

2 (Amended). Method according to Claim 1, wherein the mixing ratio between the liquid disinfectant and the steam is approximately 2:1.

3 (Amended). Method according to Claim 1, wherein the steam which is led into the mixing nozzle is at a pressure of approximately 2 bar and at a temperature of approximately 121°C.

4 (Amended). Method according to Claim 1, wherein the disinfectant which is led into the mixing nozzle is at room temperature.

5 (Amended). Method according to Claim 1, and the step of having the packaging containers [are] at room temperature before they are exposed to the mixed jet exiting from the mixing nozzle.

6 (Amended). Method according to Claim 1, and the step of forming the disinfectant which is led into the mixing nozzle to consist of an aqueous solution of H₂O₂ and peracetic acid.

7 (Amended). Method according to Claim 1, and wherein the spraying time of the mixing nozzle per packaging container is from approximately one to two seconds.

8 (Amended). Method according to Claim 1, and wherein the time of action of the disinfectant-steam mist which condenses on the packaging container is approximately five to ten seconds.

9 (Amended). Method according to Claim 1, and, before the removal of the condensate which has condensed on the packaging container, rinsing the packaging container with a liquid disinfectant.

10 (Amended). Method according to Claim 1, and the step of holding the bottle and the mixing nozzle associated with it immobile with respect to each other while the disinfectant-steam mixture is blown onto the bottle.

11 (Amended). Method according to Claim 1, and the step of continuously moving the bottle and the associated mixing nozzle together in a translation motion while the disinfectant-steam is blown onto the bottle.

12 (Amended). Method according to Claim 1, and the step of blowing the mixed jet directly through the mixing nozzle into the interior of the packaging container.

13 (Amended). Device for sterilization of packing containers having a conveyor for moving the packaging container to be sterilized, comprising in combination: at least one mixing nozzle (2) aimed directly onto the packaging containers (1) transported by the conveyor (11), said mixing nozzle (2) being connected by simultaneously opening control valves (20, 21) to a steam generator (24) and to a reservoir (26) for a liquid disinfectant (3).

14 (Amended). Device according to Claim 13, wherein said mixing nozzle (2) is designed as a two-component atomization nozzle.

15 (Amended). Device according to Claim 13, wherein said mixing nozzle (2) is aimed toward the mouth opening of a packaging container (1).

16 (Amended). Device according to Claim 13, wherein the conveyor (11) transports the packaging container (1) in an upright position and in a horizontal direction, and said mixing nozzle (2) is directed vertically downward onto the packaging container (1).

17 (Amended). Device according to Claim 13, wherein the conveyor (11) can be driven continuously and several said mixing nozzles (2) are provided which move with the conveyor (11).

18 (Amended). Device according to Claim 13, wherein the conveyor (11) is designed as a rotor which carries several holders (13) for the packaging containers (1) on the circumference and several said mixing nozzles (2) are associated with the conveyor (11), with at least one said mixing nozzle above each said holder (13).

19 (Amended). Device according to Claim 13, wherein said control valves (20, 21) which are associated with each said mixing nozzle (2) are arranged on the conveyor (11) and connected with intercalation of a rotating distributor (27) and by lines (22, 23) to said steam generator (24) and said reservoir (26).

Please add the following new claims:

20. Method according to Claim 6, and forming the disinfectant to include a surfactant.

21. Method according to Claim 12, and wherein the mixed jet is blown directly into the interior of the packaging container through its mouth opening.

REMARKS

The claims have now been reviewed and amended to conform to U.S. practice, but have not been narrowed. The specification has been given headings, and a substitute Abstract has been provided on a separate sheet. No new matter has been added.

Attached hereto is a marked-up version of the changes made to the specification and

claims by the current amendment. The attached page is captioned "Version with markings to show changes made".

It is respectfully submitted the application as amended above is now in condition for substantive examination on the merits. If any claim or other fees are due by this Amendment, please charge our deposit account No. 13-2855.

Respectfully submitted,

Erwin Knieling et al, Applicants

Date: July 12, 2001

By Richard B. Hoffman
~~Richard B. Hoffman, Reg. No. 26,910~~
Attorney for Applicants

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Abstract

[In a method] Method and apparatus for the sterilization of packaging containers, in particular bottles, wherein a mixture of a liquid disinfectant and steam is led simultaneously, and separately, [led] into a mixing nozzle, and the resulting mixed jet, consisting of atomized and/or evaporated disinfectant and steam, which exits from the mixing nozzle is led directly onto or into a packaging container. This method is easy to use, it works with operational reliability, and it allows the reliable sterilization of packaging containers having a relatively small mouth opening.

VERSION WITH MARKINGS TO SHOW CHANGES MADE
IN THE SPECIFICATION:

At page 1, after the title, please delete the word “Description” and add a new centered heading as follows:

--Field of the Invention--;

Page 1, please delete the first full paragraph and substitute with the following:

--The invention relates to a method and apparatus for the sterilization of packaging containers such as PET beverage bottles.--

Page 1, after the first full paragraph, please add a new centered heading as follows:

--Background of the Invention--;

Page 1, please delete the fourth full paragraph and substitute with the following:

--A known method also exists which is designed for the sterilization of PET bottles, where peracetic acid at a concentration of 0.1-1.5% is continuously sprayed into a pipe which carries pressurized air, by means of an atomization nozzle (DE 198 08 318 A1). The aerosol so formed is then heated in a heat exchanger, and then it is led through pipes and single-component nozzles into inverted PET bottles. After the exposure, the sterilization agent is removed by rinsing the PET bottles by spraying demineralized water.--

Page 2, after carryover paragraph, please insert a centered heading as follows:

--Summary of the Invention--;

Page 2, please delete second full paragraph.

Page 2, please delete the fourth paragraph and substitute with the following:

--Because of the direct application by spraying of the disinfectant-steam mixture onto the packaging containers by the mixing nozzles, no heating chamber, pipes etc. are needed, in which the mixture could condense. The mixing nozzles can thus be operated in cycles, and

even longer interruptions of the operation have no negative effects. By an appropriate design of the mixing nozzles, and the resulting shape of the jets of the mist-like mixture, the latter can be blown or applied as a mist into narrow mouth openings or broadside onto the external wall of packaging containers. In addition, it is possible to set an exact dosage of the mixture which is applied as a mist onto a packaging container, and thus achieve a considerable savings in consumption.--

Page 2, after fourth full paragraph and insert a centered heading as follows:

--Brief Description of the Drawings--.

Page 3, please delete description of Figure 3 and substitute with the following:

--Figure 3 is detail X of Figure 2 at an enlarged scale--;

Page 3, after description of Figure 5, please insert a new centered heading as follows:

--Detailed Description of the Invention--.

Page 3, please delete second full paragraph and substitute with the following:

--The injection machine 5 has a stationary housing 10, on which a rotating table 11 with a vertical rotating axle 12 is located. On the circumference of the rotating table 11, a number of elastic gripping tongs 13 according to European Patent 721 808 are rigidly attached, in an even distribution. These gripping tongs 13 hold the bottles 1 by a section below the collar of the neck in an upright position and with the opening turned upward, while the bottles move in a rotating path with the rotating table 11. The introduction and the removal of the bottles 1 into/out of the gripping tongs 13 occur by means of a one-part worm 14, an input star 17, as described in detail in the mentioned European Patent 721,808. A pivoting of the bottles by 180° does, however, not occur. In the crosshatched treatment area, the bottles always remain in the upright normal position.--

IN THE CLAIMS:

Please delete Claims at top of page.

At line 1, before claim 1, please insert --We claim--.

Please amend the claims to read as follows:

1 (Amended). Method for the sterilization of packaging containers, comprising the steps of generating [where] a heated disinfectant [is generated using a nozzle, then it is led to the packaging containers and after it has acted on the surface to be sterilized, it is again removed, characterized in that] by simultaneously and separately leading a liquid disinfectant and steam [are separately led] to a mixing nozzle, [in that] forming a mixture of atomized [and/]or evaporated disinfectant and steam [is formed] by the mixing nozzle, [and in that] aiming the mixed jet of heated disinfectant which exits from the mixing nozzle [is aimed] directly onto a packaging container, and removing the heated disinfectant after it has acted on the surface of the packing container to be sterilized.

2 (Amended). Method according to Claim 1, [characterized in that] wherein the mixing ratio[n] between the liquid disinfectant and the steam is approximately 2:1.

3 (Amended). Method according to Claim 1 [or 2, characterized in that], wherein the steam which is led into the mixing nozzle is at a pressure of approximately 2 bar and at a temperature of approximately 121°C.

4 (Amended). Method according to [one of] Claim[s] 1[-3, characterized in that],
wherein the disinfectant which is led into the mixing nozzle is at room temperature.

5 (Amended). Method according to [one of] Claim[s] 1[-4, characterized in that], and
the step of having the packaging containers [are] at room temperature before they are exposed
to the mixed jet exiting from the mixing nozzle.

6 (Amended). Method according to [one of] Claim[s] 1[-5, characterized in that],
and the step of forming the disinfectant which is led into the mixing nozzle to consist[s] of an
aqueous solution of H₂O₂ [,] and peracetic acid [and optionally a surfactant].

7 (Amended). Method according to [one of] Claim[s] 1[-6, characterized in that], and
wherein the spraying time of the mixing nozzle per packaging container is from
approximately one to two seconds.

8 (Amended). Method according to [one of] Claim[s] 1[-7, characterized in that], and
wherein the time of action of the disinfectant-steam mist which condenses on the packaging
container is approximately five to ten seconds.

9 (Amended). Method according to [one of] Claim[s] 1[-8, characterized in that],
and, before the removal of the condensate which has condensed on the packaging container,
rinsing the packaging container [is rinsed] with a liquid disinfectant.

10 (Amended). Method according to [one of] Claim[s] 1[-9, characterized in that],
and the step of holding the bottle and the mixing nozzle associated with it [are] immobile
with respect to each other while the disinfectant-steam mixture is blown onto the bottle.

11 (Amended). Method according to Claim 1, [characterized in that], and the step of continuously moving the bottle and the associated mixing nozzle together [are continuously moved] in a translation motion while the disinfectant-steam is blown onto the bottle.

12 (Amended). Method according to [one of] Claim[s] 1[-11, characterized in that], and the step of blowing the mixed jet [is blown] directly through the mixing nozzle into the interior of the packaging container[, preferably through its mouth opening].

13 (Amended). Device for [using the method according to Claim 1, with] sterilization of packing containers having a conveyor for moving the packaging container to be sterilized, comprising in combination: [and] at least one [nozzle, characterized in that at least one] mixing nozzle (2) [is] aimed directly onto the packaging containers (1) transported by the conveyor (11) [and in that the], said mixing nozzle (2) [is connecter] being connected by simultaneously opening control valves (20, 21) to a steam generator (24) and to a reservoir (26) for a liquid disinfectant (3).

14 (Amended). [Method] Device according to Claim 13, [characterized in that the] wherein said mixing nozzle (2) is designed as a two-component atomization nozzle.

15 (Amended). Device according to Claim 13 [or 14, characterized in that the], wherein said mixing nozzle (2) is aimed toward the mouth opening of a packaging container (1).

16 (Amended). Device according to [one of] Claim[s] 13[-15, characterized in that], wherein the conveyor (11) transports the packaging container (1) in an upright position and in a horizontal direction, and [in that the] said mixing nozzle (2) is directed vertically downward onto the packaging container (1).

17 (Amended). Device according to Claim [18, characterized in that] 13, wherein the conveyor (11) can be driven continuously and [in that] several said mixing nozzles (2) are provided which move with the conveyor (11).

18 (Amended). Device according to Claim [19, characterized in that] 13, wherein the conveyor (11) is designed as a rotor which carries several holders (13) for the packaging containers (1) on the circumference and [in that] several said mixing nozzles (2) are associated with the conveyor (11), with at least one said mixing nozzle above each said holder (13).

19 (Amended). Device according to Claim [18, characterized in that the] 13, wherein said control valves (20, 21) which are associated with each said mixing nozzle (2) are arranged on the conveyor (11) and connected with intercalation of a rotating distributor (27) and by lines (22, 23) to [the] said steam generator (24) and [the] said reservoir (26).

Please add the following new claims:

20. Method according to Claim 6, and forming the disinfectant to include a surfactant.

21. Method according to Claim 12, and wherein the mixed jet is blown directly into the interior of the packaging container through its mouth opening.

Method and Device for the Sterilization of Packaging ContainersDescription

The invention relates to a method for the stabilization of packaging containers according to the preamble of Claim 1, and to a suitable device according to the preamble of Claim 13

Such a method is already known, in which a H₂O₂-steam mixture is led through a two-substance nozzle and a heating chamber, as well as a pipe, into a sterilization chamber (DE 39 00 448 A1). The packaging containers to be treated, which are in the form of conical beakers made of plastic, are moved through the sterilization chamber, and exposed in the process to a diffuse, heated, mixture of H₂O₂ and steam. In addition, hot air is blown into the sterilization chamber for the purpose of decomposing the H₂O₂. Then the remainders of the sterilization agent and of the mixture are removed by suction from the sterilization chamber.

The course of this known method is very complex and accordingly it is expensive to use. Because of the undirected, diffuse, introduction of the mixture of H₂O₂ and steam into the sterilization chamber, it is only suitable for packaging containers having a relatively large mouth opening, and not for packaging containers having a small opening, such as, for example, plastic bottles for drinks, which are increasingly used in the drink industry.

A known method also exists which is designed for the sterilization of PET bottles, where peracetic acid at a concentration of 0.1-1.5% is continuously sprayed into a pipe which carries pressurized air, by means of an atomization nozzle (DE 198 08 318 A1). The aerosol so formed is then heated in a heat exchanger, and then it is led through pipes and single-component nozzles into inverted PET bottles. After the exposure, the sterilization agent is removed by rinsing the PET bottles by spraying demineralized water.

Although this method can also be used to sterilize packaging containers with a small neck, its use requires very expensive equipment. An additional problem arises during the unavoidable

interruptions in the operation, when the heated aerosol can condense in the long pipes leading to the nozzles. This leads to imperfectly sterilized packaging containers after the interruption.

The invention is based on the problem of providing a method which is simple to use and which works reliably for the sterilization of packaging containers, by means of which packaging containers having a relatively small mouth opening can also be reliably sterilized. In addition, a cost effective device for using the method is described.

This problem is solved, as far as the method is concerned, by the characteristics of Claim 1, and, as far as the device is concerned, by the characteristics of Claim 13.

In the method according to the invention, both the atomization or evaporation as well as the heating of the liquid disinfectant occur solely by mixing with steam. In this context, the heating can be defined most simply by choosing the temperature and the quantity of the steam. The resulting "dilution" can also be compensated for in a simple manner by a corresponding increase in the initial concentration of the disinfectant which is led into the mixing nozzle, so that the mixture which condenses on the packaging containers, which are preferably at room temperature, presents the desired concentration.

Because of the direct application by spraying of the disinfectant-steam mixture onto the packaging containers by the mixing nozzles, no heating chamber, pipes etc. are needed, in which the mixture could condense. The mixing nozzles can thus be operated in cycles, and even longer interruptions of the operation have no negative effects. By an appropriate design of the mixing nozzles, and the resulting shape of the jets of the mist-like mixture, the latter can be blown or applied as a mist into narrow mouth openings or broadside onto the external wall of packaging containers. In addition, it is possible to set an exact dosage of the mixture which is applied as a mist onto a packaging container, and thus achieve a considerably saving in consumption.

Advantageous embodiments of the invention are provided in the dependent claims.

In the following embodiment example, the invention is described with reference to the drawings.
In the drawings,

Figure 1 is a schematic top view of a device for the sterilization of packaging containers
Figure 2 is a cross section along AA in Figure 1 at an enlarged scale
Figure 3 is detail X at an enlarged scale
Figure 4 is a cross section along CD in Figure 1 at an enlarged scale
Figure 5 is a cross section along EF in Figure 1 at an enlarged scale

The device of Figures 1-5 is designed for the sterilization of packaging containers in the form of PET bottles for drinks, which hereafter will be called bottles 1 for short. It essentially comprises an injection machine 5, a rinsing machine (rinser) 6, and a conveyor 7 which connects the two machines. The bottles 1 to be sterilized are led to the device by an input conveyor 8, while they are in an upright position; the sterilized bottles 1 are led away from the device, while in an upright position, by an output conveyor 9.

The injection machine 5 has a stationary housing 10, on which a rotating table 11 with a vertical rotating axle 12 is located. On the circumference of the rotating table 11, a number of elastic gripping tongs 13 according to European Patent 721 808 are rigidly attached, in an even distribution. These gripping tongs 13 hold the bottles 1 by a section below the collar of the neck in an upright position and with the opening turned upward, while the bottles move in a rotating path with the rotating table 11. The introduction and the removal of the bottles 1 into/out of the gripping tongs 13 occur by means of a one-part worm 14, an input star 17, as described in detail in the mentioned European Patent 721 808. A pivoting of the bottles by 180° does, however, not occur. In the crosshatched treatment area, the bottles always remain in the upright normal position.

Moreover, on the rotating table 11 of the injection machine 5 a number of two-component atomization nozzles with a spraying angle of approximately 20°, hereafter called Mixing nozzles 2 for short, are rigidly attached. More precisely, above each gripping tong 13, concentrically with respect to a bottle 1 held by the gripping tong, a mixing nozzle 2 is directed vertically downward in each case, and at a small distance (approximately 2 cm) from the mouth opening of the bottle 1.

The first duct 18 of each mixing nozzle 2 is connected above the first lines 22 with intercalation of a first control valve 20 and a rotating distributor 27 arranged concentrically with respect to the rotating axle 12 to a stationary steam generator 24. The latter delivers steam at an excess pressure of 2 bar and a temperature of 121°C. The second duct 19 of each mixing nozzle 2 is connected by a second line 23 and with intercalation of a second control valve 21 as well as a rotating distributor 27 and a pump 25 to a stationary reservoir tank 26 for a disinfectant 3 which is at room temperature. The latter disinfectant consists of an aqueous solution of 4% disinfectant concentrate and 0.04% of a surfactant to improve wetting. This liquid disinfectant 3 is led by the pump 25 at an excess pressure of 2 bar to the mixing nozzles 2. The disinfectant contains as germicidal components 4000 ppm of H₂O₂ and 2500 ppm of peracetic acid.

With the above-described installations of the injection machine 5 an atomized mixture of liquid disinfectant 3 and steam 4 is blown into the interior of the bottles 1. To sterilize the exterior surface of the bottles 1 as well, after the input star 15, several mixing nozzles 2a are arranged in a stationary pattern and at a small distance laterally with respect to the path of movement of the bottles 1. These mixing nozzles 2a—with the exception of the rotating distributor 27 which is not required here—are connected in the same manner as the mixing nozzles 2 which move in a circular path with the rotating table by the lines 23 and the control valves 21 to the reservoir tank 26, and they are oriented horizontally. In addition, they are connected by lines 38 to a source of sterile pressurized air.

The rinsing machine 6 according to Figures 1 and 5 in part has a similar structure to that of the injection machine 5 according to Figures 1-4. Identical parts are therefore denoted with the same reference numeral and the addition "a." Here the elastic gripping tongs 13a can be pivoted about horizontal pivoting axles 28 by means of a cam control 29, as described in detail in European Patent No. 721 808. For most of their circular movement with the rotating table 11, the bottles 1 are therefore inverted, that is their mouth opening is directed downward. In the area of the input star 15a and the output star 16a, in contrast, they are in the upright normal position.

The treatment of the bottles 1 in the rinsing machine 6 occurs by means of the nozzles 30, which are arranged on the rotating table 11a, associated with the gripping tongs 13a, and which can be

slightly inserted into the bottles 1. Each nozzle 30 is connected by one control valve 31, 32, 33 to a total of three ducts 34, 35, 36, in each case, which contain different rinsing media. In the present case, these media are sterile air, sterile water and liquid disinfectant 3, preferably the same one as contained in the reservoir tank 26. The nozzle 30 is designed as a one- or multi-pipe nozzle, so that optionally different rinsing media can be introduced into the bottle 1.

The conveyor belt 7 connects the output star 16 of the injection machine 5 with the output worm 14a and the input worm 15a of the rinsing machine 6. Its length is such that in the case of the nominal performance of the device, the desired time of action of the disinfectant-steam mist introduced as a mist into the bottle in the injection machine 5 is achieved. During normal operation, the injection machine 5, the conveyor belt 7, and the rinsing machine 6 are driven synchronously with respect to each other, so that the result is a disturbance-free, continuous, transport of the bottles 1 from the input conveyor 8 to the output conveyor 9. The entire device is arranged in a chamber 37 drawn with a dot-dash line, which is supplied with sterile air of class 100. Thus any reinfection of the sterilized bottles 1 is prevented.

Using the above-described device, the sterilization process described below is carried out:

A bottle 1, delivered by a stretching-blowing machine which is not shown, is brought by the input conveyor 8, introduced into the cycle by the input worm 14, and transferred from the input star 15 to a gripping tong 13 of the injection machine 5. It is now located in the middle in the position indicated in Figures 2 and 3 under the mixing nozzle 2 which is associated with the gripping tong 13, which nozzle is at a distance of two to three centimeters from the mouth of the bottle. Then the two control valves 20 and 21 of the mixing nozzle 2 are synchronously opened for a period of 1.5 sec. In this process the mixing nozzle 2 receives, separately, from the reservoir tank 26, liquid disinfectant 3 having the already described composition, at room temperature and at an excess pressure of b_2 bar, and, from the steam generator 24, steam at an excess pressure of 2 bar and at a temperature of 121°C . At the time of the exit from the ducts 18, 19 of the mixing nozzle 2, the two components are intensively mixed, resulting in a high energy mixed jet at a temperature of approximately $60\text{--}80^\circ\text{C}$ and with an opening angle of approximately 20° . The mixed jet essentially contains a finely atomized disinfectant, steam, and

optionally evaporated disinfectant and water droplets. As a result of the catalytically acting temperature increase or addition of heat, the disinfectant 3 is optimally activated.

The mixing nozzle 2 is arranged and designed in such a manner that the mixed jet which it generates penetrates essentially vertically downward through the mouth opening into the interior of the bottle 1, and fills it completely. Since the bottle 1 is only at room temperature, most of the mixture condenses in the form of very fine droplets on the interior wall of the bottle and forms a closed, highly active, germicidal condensate film. The internal temperature of the bottle here increases to approximately 45°C due to the overall low heat content of the mixture which is sprayed in.

Moreover, as a result of the described process, the environmental air which is originally contained in the bottle 1 is for the most part expelled out of the interior of the bottle. At the end of the 1.5 sec spraying time, the two control valves 20, 21 are synchronously closed. The described 1.5 sec of spraying time occupy the crosshatched rotating area of the rotating table 11, in Figure 1. This time period is followed by a time of action lasting 5 sec, which is marked by the shaded area of the rotating table 11. Here the disinfectant 3 applied as a mist onto the internal wall of the bottle acts as a germicidal agent. The exterior area of the mouth of the bottle is also treated by the exiting mixture.

In the final phase of the rotating area of the bottle 1 with the rotating table 11, a 1.5 sec introduction of a spray consisting of a disinfectant-steam mixture again occurs through the same mixing nozzle 2. Here the interior of the bottle is heated to approximately 58°C. The critical temperature for PET bottles of approximately 65°C is thus not even approximated. The bottle 1 is then grabbed by the output star 16 and the guide arch 17, and it is deposited on the conveyor 7. Next there is a time of action which depends on the length of the conveyor belt 7, which can be varied depending on the type of the bottle, the desired sterilization effect and the desired disinfectant, and which is preferably in the range of 5-10 sec.

Due to the direct application onto the interior of the bottle by the mixing nozzle 2 and its exactly timed control, an exact dosage of the disinfectant 3 and the steam 4 which are introduced as a

mist is possible. Thus, for example, during the sterilization of a 1.5 L PET bottle with the described parameters and a mixing nozzle 2 having corresponding dimensions, during the 1.5 sec of the phase of injection by spraying into the bottle 1, in each case 3.4 mL of disinfectant 3 and 1.4 g of steam 4 are injected through the nozzle. At a rate of 19,000 Fl/h, the resulting consumption per hour is 129.2 L of disinfectant 3 and 53.2 kg of steam 4. The achievable germicidal rates are 99.99-99.999%, depending on the types of test germs used. This satisfies all the requirements for the sterile filing of drinks into PET bottles.

In addition, there is optionally the consumption of 33 L per H of disinfectant 3 for the external sterilization of the bottles 1 through the nozzles 2a in the inlet area of the rotating table 11, by means of which, if required, a reinfection of the interior of the bottle by germs on the exterior of the bottle can reliably be prevented.

At the end of the conveyor belt 7 the bottle 1, which carries on its interior and on its exterior, a film of disinfectant, is entered into the cycle by the input worm 14a, and transferred from the input star 15a in the upright position in a gripping tong 13a of the rinsing machine 6. Then the gripping tong 13a is pivoted, during the rotation of the rotating table 11a, through the control device 29 by 180°, so that the bottle 1 finally points downward with its opening. In this process, the nozzle 30 penetrated by a few millimeters into the mouth of the bottle (Figure 5). Now, by means of a corresponding control of the control valves 31, 32, 33, first, for a short time, liquid disinfectant is sprayed into the bottle 1 (cross-hatched area) and then the bottle 1 is alternately rinsed with sterile water and sterile air (shaded area) until the last residues of the disinfectant are almost completely removed from the bottle 1. The bottle is tilted back into the normal position, taken up by the output star 16a, and deposited on the output conveyor 9 in the upright normal position. By the latter conveyor it is transported to a sterile filling and closing machine, not shown, in an atmosphere which contains few or no germs, as exists in the chamber 37.

Instead of the conveyor belt 7, one or more transport stars can also be used to transport the bottles 1, in the appropriate distribution. As a result of this modular construction, the injection machine 5 and the rinsing machine 6 can be arranged immediately next to each other, taking up as little space as possible. It is also possible, to transfer the bottles 1 directly from the output star

16a of the rinsing machine to the input star of the filling and closing machine. In this construction as well, appropriate dimensions of the transport star can achieve the desired treatment and action times. In particular in cases where the sterility requirements are low, it is also conceivable to provide the mixing nozzles 10 on a rotating table which rotates with the input star 15a of the rinsing machine 6, where the time of action is then shifted to the area of the rotating table 11a. In all cases, the direct application onto the bottles 1 of the disinfectant-steam mixture exiting from the mixing nozzles 10 results in a low-consumption, reliable and reproducible sterilization treatment.

Claims

1. Method for the sterilization of packaging containers, where a heated disinfectant is generated using a nozzle, then it is led to the packaging containers and, after it has acted on the surface to be sterilized, it is again removed, characterized in that simultaneously a liquid disinfectant and steam are separately led to a mixing nozzle, in that a mixture of atomized and/or evaporated disinfectant and steam is formed by the mixing nozzle, and in that the mixed jet which exits from the mixing nozzle is aimed directly onto a packaging container.
2. Method according to Claim 1, characterized in that the mixing ration between the liquid disinfectant and the steam is approximately 2:1.
3. Method according to Claim 1 or 2, characterized in that the steam which is led into the mixing nozzle is at a pressure of approximately 2 bar and at a temperature of approximately 121°C.
4. Method according to one of Claims 1-3, characterized in that the disinfectant led into the mixing nozzle is at room temperature.
5. Method according to one of Claims 1-4, characterized in that the packaging containers are at room temperature before they are exposed to the mixed jet exiting from the mixing nozzle.
6. Method according to one of Claims 1-5, characterized in that the disinfectant which is led into the mixing nozzle consists of an aqueous solution of H₂O₂, peracetic acid and optionally a surfactant.
7. Method according to one of Claims 1-6, characterized in that the spraying time of the mixing nozzle per packaging container is one to two seconds.

8. Method according to one of Claims 1-7, characterized in that the time of action of the disinfectant-steam mist which condenses on the packaging container is approximately five to ten seconds.

9. Method according to one of Claims 1-8, characterized in that before the removal of the condensate which has condensed on the packaging container the packaging container is rinsed with a liquid disinfectant.

10. Method according to one of Claims 1-9, characterized in that the bottle and the mixing nozzle associated with it are immobile with respect to each other while the disinfectant-steam mixture is blown onto the bottle.

11. Method according to Claim 1, characterized in that the bottle and the associated mixing nozzle together are continuously moved in a translation motion while the disinfectant-steam is blown onto the bottle.

12. Method according to one of Claims 1-11, characterized in that the mixed jet is blown directly through the mixing nozzle into the interior of the packaging container, preferably through its mouth opening.

13. Device for using the method according to Claim 1, with a conveyor for the packaging container to be sterilized and at least one nozzle, characterized in that at least one mixing nozzle (2) is aimed directly onto the packaging containers (1) transported by the conveyor (11) and in that the mixing nozzle (2) is connected by simultaneously opening control valves (20, 21) to a steam generator (24) and a reservoir (26) for a liquid disinfectant (3).

14. Method according to Claim 13, characterized in that the mixing nozzle (2) is designed as a two-component atomization nozzle.

15. Device according to Claim 13 or 14, characterized in that the mixing nozzle (2) is aimed toward the mouth opening of a packaging container (1).

16. Device according to one of Claims 13-15, characterized in that the conveyor (11) transports the packaging container (1) in an upright position and in a horizontal direction, and in that the mixing nozzle (2) is directed vertically downward onto the packaging container (1).

17. Device according to Claim 18, characterized in that the conveyor (11) can be driven continuously and in that several mixing nozzles (2) are provided which move with the conveyor (11).

18. Device according to Claim 19, characterized in that the conveyor (11) is designed as a rotor which carries several holders (13) for the packaging containers (1) on the circumference and in that several mixing nozzles (2) are associated with the conveyor (11), at least one above each holder (13).

19. Device according to Claim 18, characterized in that the control valves (20, 21) which are associated with each mixing nozzle (2) are arranged on the conveyor (11) and connected with intercalation of a rotating distributor (27) and by lines (22, 23) to the steam generator (24) and the reservoir (26).

Abstract

In a method for the sterilization of packaging containers, in particular bottles, a mixture of a liquid disinfectant and steam is simultaneously, and separately, led into a mixing nozzle, and the mixed jet, consisting of atomized and/or evaporated disinfectant and steam, which exits from the mixing nozzle is led directly onto or into a packaging container. This method is easy to use, it works with operational reliability, and it allows the reliable sterilization of packaging containers having a relatively small mouth opening.

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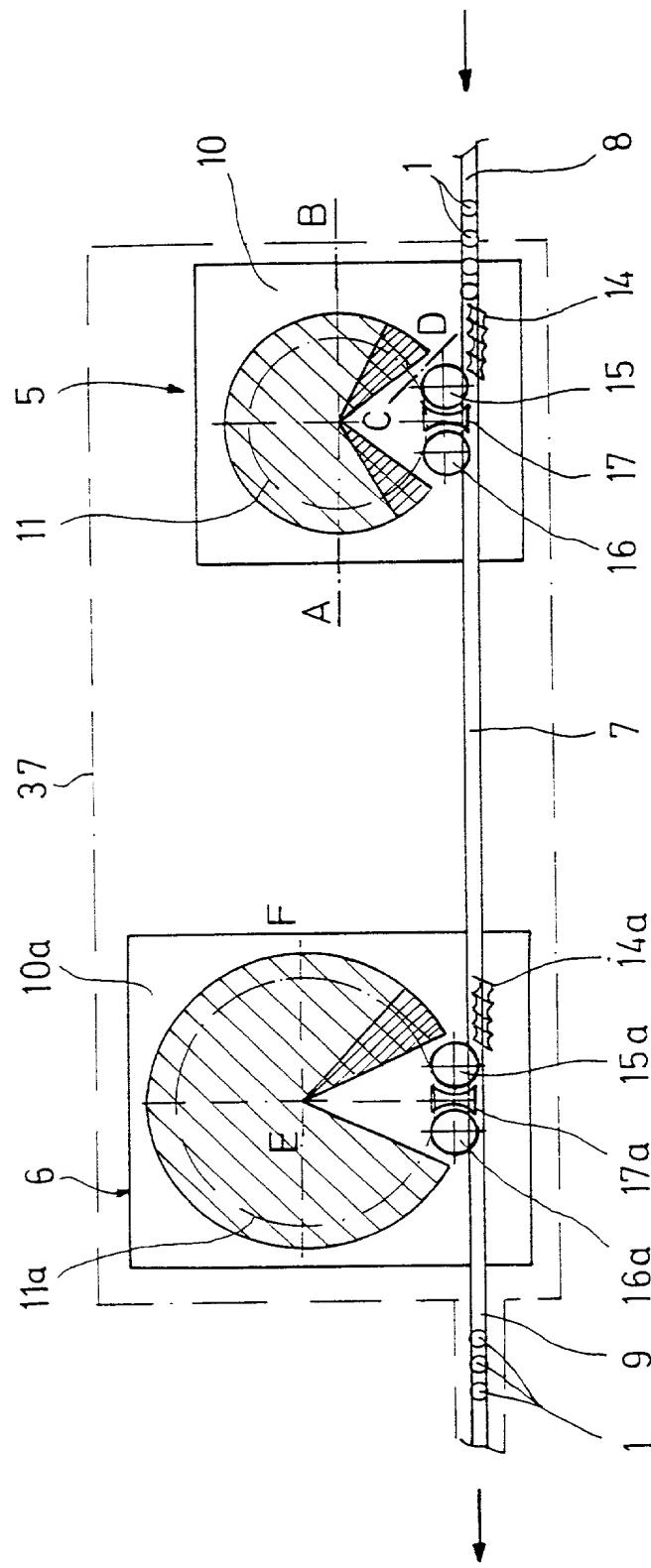


FIG. 1

09/889439

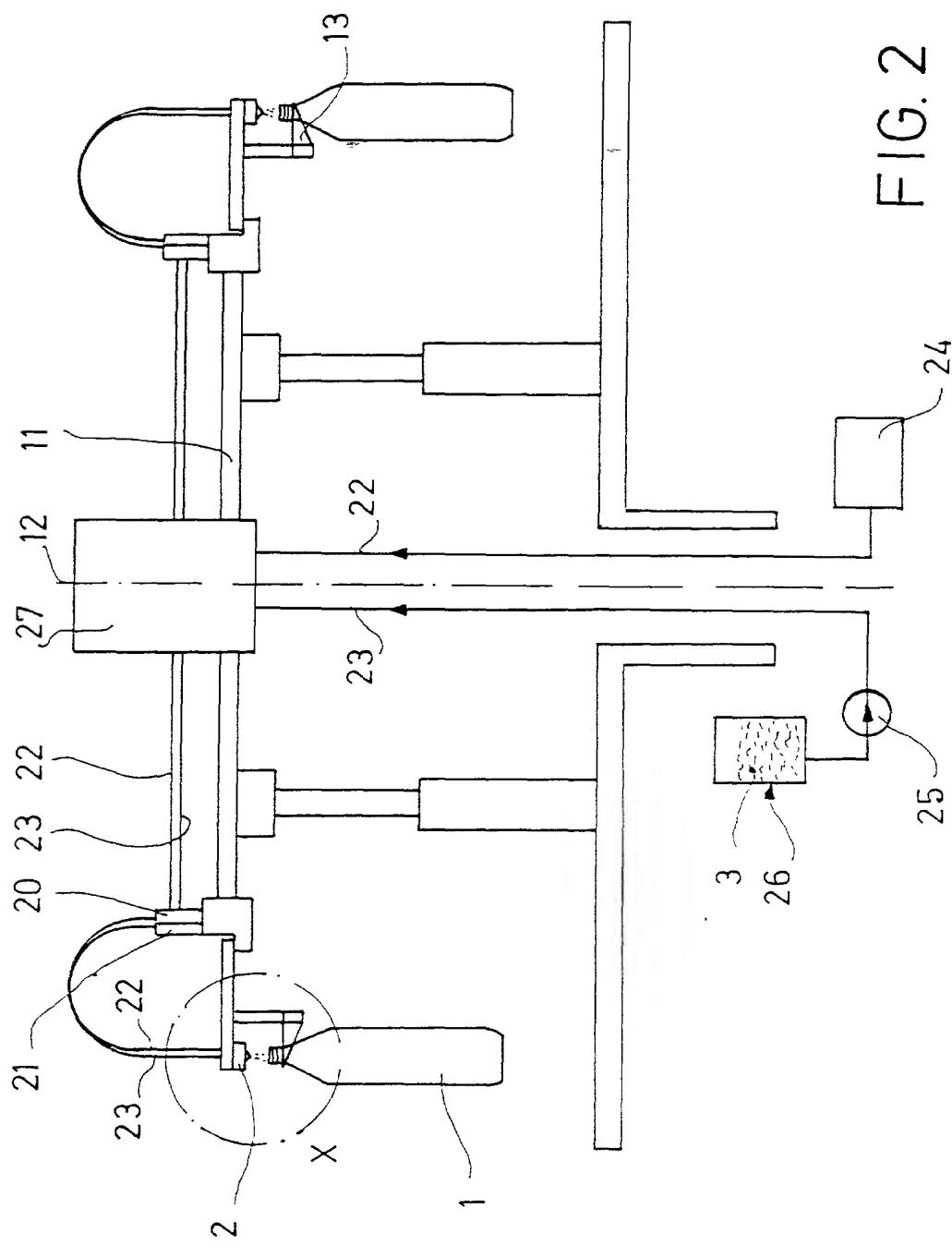


FIG. 3

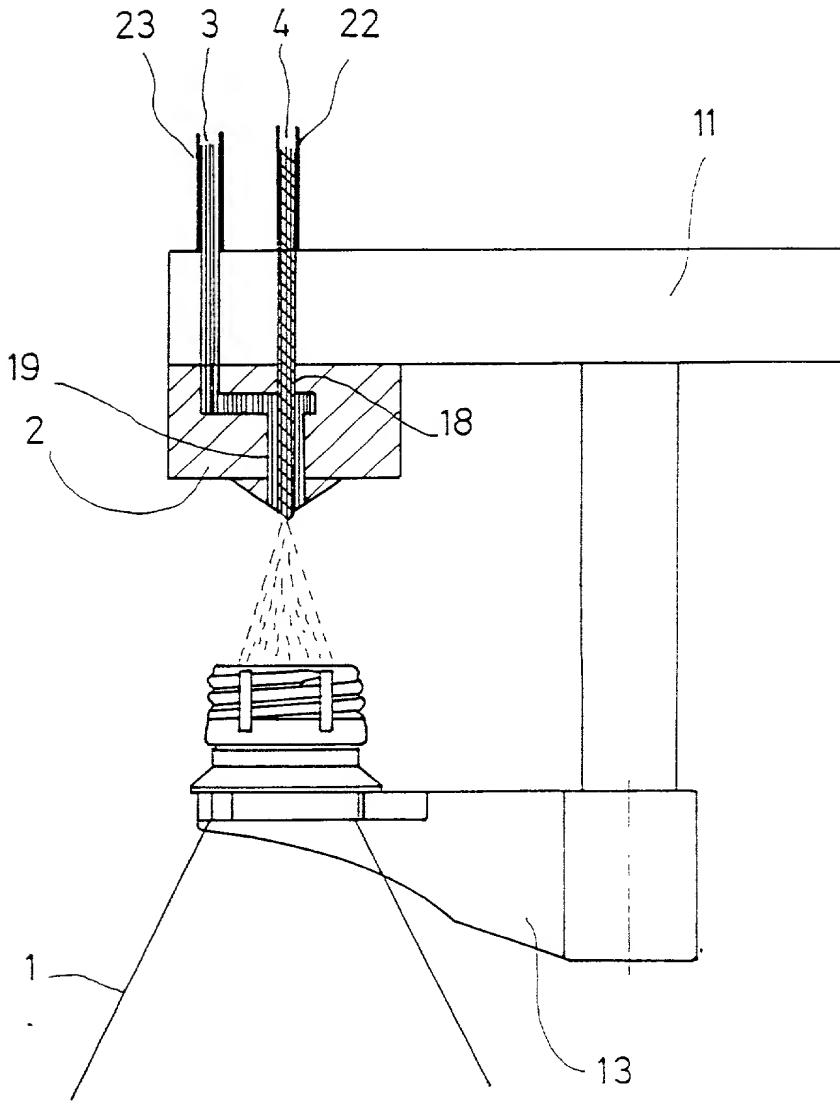


FIG. 4.

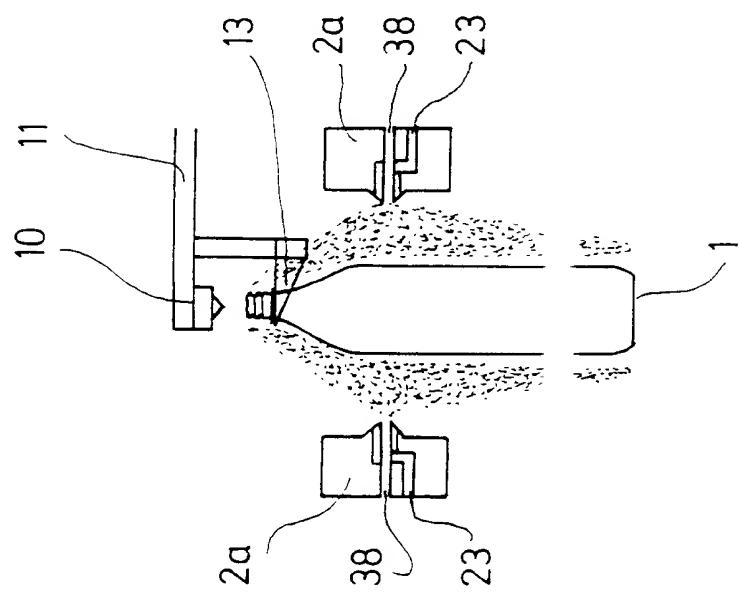
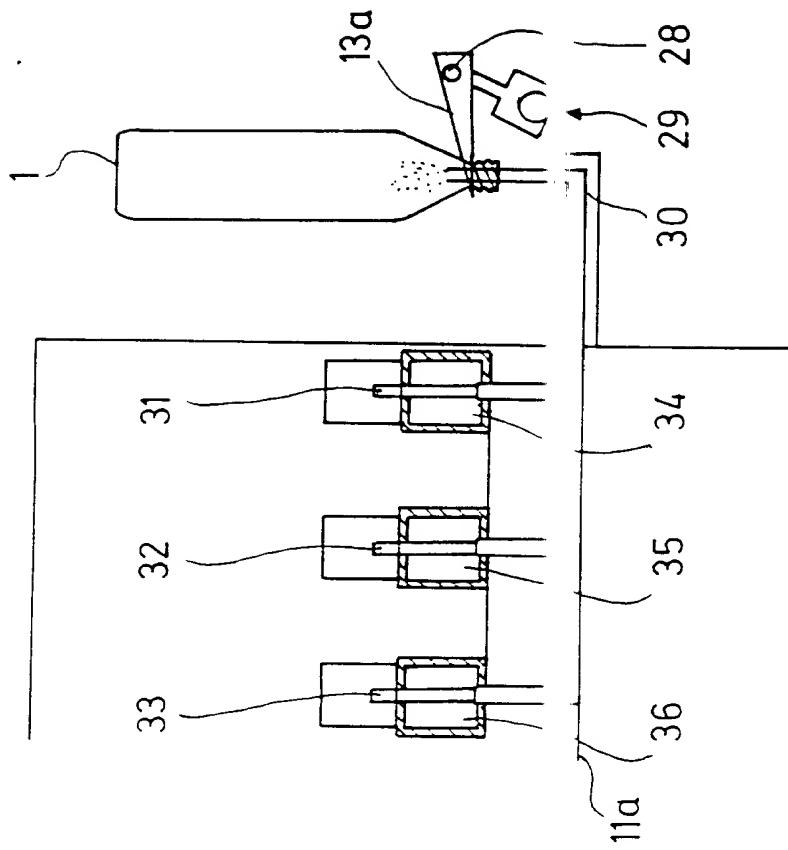


FIG. 5



09/889439

ERWIN KNIFFLING ET AL
Sheet 4 of 4 Sheets
Attorney Docket No. 30071/37530
(FIGS. 4 & 5)

DECLARATION FOR PATENT APPLICATION AND POWER OF ATTORNEY

As a below named inventor, I hereby declare that my residence, post office address and citizenship are as stated below next to my name; I believe that I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled "METHOD AND DEVICE FOR THE STERILIZATION OF PACKAGING CONTAINERS," the specification of which (check one): is attached hereto; was filed on July 12, 2001 as Application Serial No. 09/889,439 and was amended on _____ (if applicable); was filed as PCT International Application No. _____ on _____ and was amended under Article 19 on _____ (if applicable). I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment(s) referred to above. I acknowledge the duty to disclose to the Patent and Trademark Office all information known to me to be material to patentability as defined in 37 C.F.R. §1.56.

I hereby claim foreign priority benefits under 35 U.S.C. §119 of any foreign application(s) for patent or inventor's certificate or of any PCT international application(s) designating at least one country other than the United States of America listed below and have also identified below any foreign application(s) for patent or inventor's certificate or any PCT international application(s) designating at least one country other than the United States of America filed by me on the same subject matter having a filing date before that of the application(s) of which priority is claimed:

			Priority Claimed
(Application Serial Number)	(Country)	(Day/Month/Year Filed)	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
199 56 186.9	Germany	22/November/1999	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No

			Priority Claimed
(Application Serial Number)	(Country)	(Day/Month/Year Filed)	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No

I hereby claim the benefit under 35 U.S.C. §119(e) of any United States provisional application(s) listed below:

(Application Serial Number)	(Day/Month/Year Filed)

(Application Serial Number)	(Day/Month/Year Filed)

I hereby claim the benefit under 35 U.S.C. §120 of any United States application(s) or PCT international application(s) designating the United States of America listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior application(s) in the manner provided by the first paragraph of 35 U.S.C. §112, I acknowledge the duty to disclose to the Office all information known to me to be material to patentability as defined in 37 C.F.R. §1.56 which occurred between the filing date of the prior application(s) and the national or PCT international filing date of this application:

(Application Serial Number)	(Day/Month/Year Filed)	(Status-Patented, Pending or Abandoned)

(Application Serial Number)	(Day/Month/Year Filed)	(Status-Patented, Pending or Abandoned)

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under 18 U.S.C. §1001 and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

POWER OF ATTORNEY: I hereby appoint as my attorneys, with full powers of substitution and revocation, to prosecute this application and transact all business in the Patent and Trademark Office connected therewith:

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